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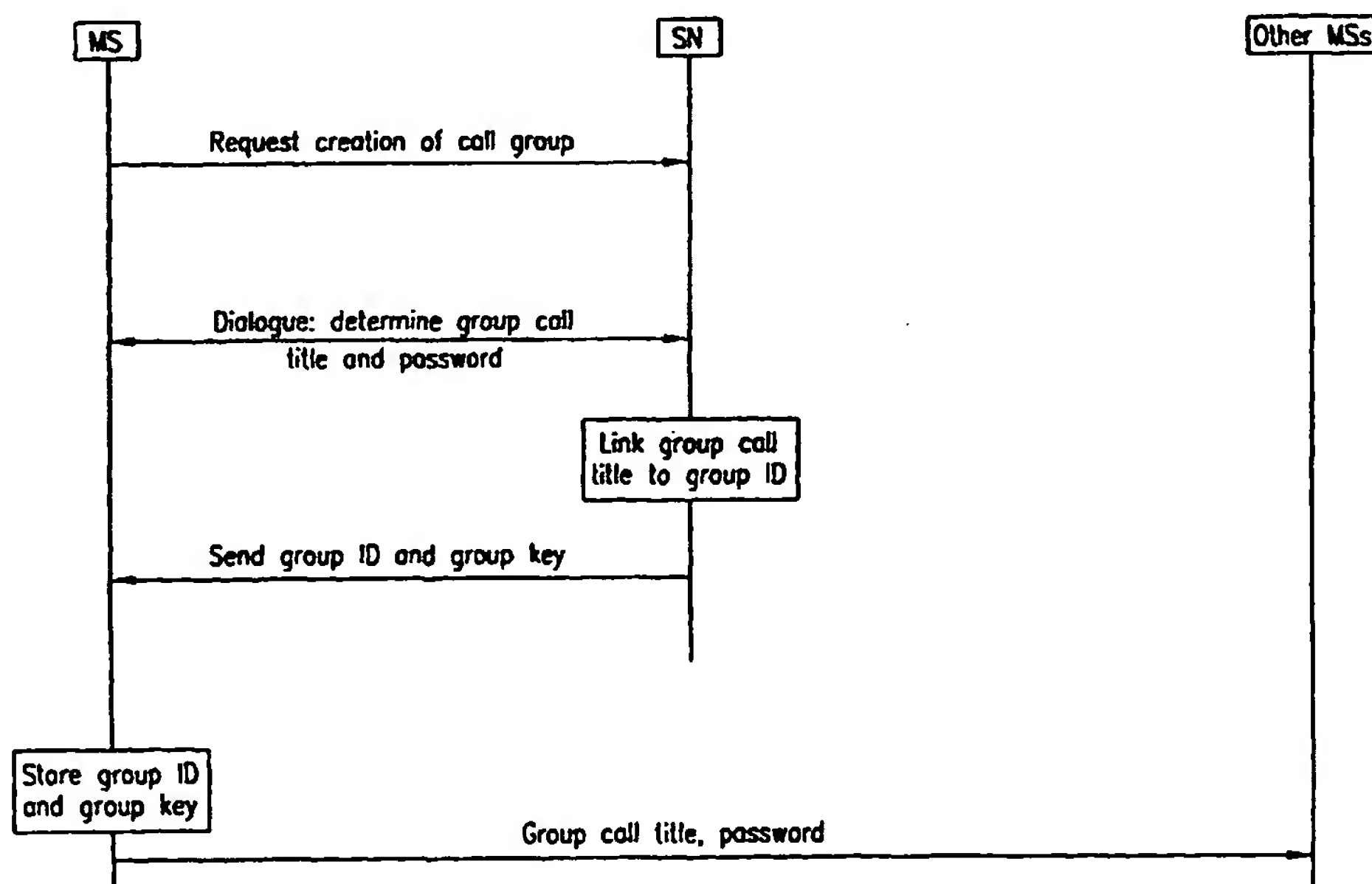
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(54) Title: **DYNAMICALLY CONTROLLED GROUP CALL SERVICES IN MOBILE TELECOMMUNICATIONS NETWORKS**



(57) Abstract: A mobile terminal (23) operating in a mobile telecommunications network (11) can create call groups and set up group calls. The group calls are dynamically controlled in response to communications received from group members.

DYNAMICALLY CONTROLLED GROUP CALL SERVICES IN MOBILE TELECOMMUNICATIONS NETWORKS

5 FIELD OF THE INVENTION

The invention relates generally to mobile telecommunications networks and, more particularly, to the provision of dynamically controlled group calls services to mobile subscriber units operating in such networks.

10 BACKGROUND OF THE INVENTION

Conventional mobile telecommunications networks, for example, digital cellular telecommunication networks according to the GSM (Global System for Mobile Communications) Standard, provide voice broadcast services that permit a subscriber to initiate a group broadcast call directed to a group of additional subscribers. Such voice broadcast service for GSM systems is specified in GSM
15 Standard 03.69 and a related GSM Standard, namely GSM 03.68.

In conventional systems such as mentioned above, a particular group is identified by a group ID. A common control channel (for example the notification channel NCH in GSM) broadcasts in the network a notification message including the
20 group ID and a description of the channel being used for the group call. Thus, users having the correct group ID stored in their mobile subscriber units (also referred to herein as mobile units, mobile terminals, mobile stations), for example stored in the SIM (Subscriber Identity Module) card of a GSM mobile unit, can recognize the notification message, and can then connect to the group call by tuning to the channel
25 described in the notification message. Also in such conventional systems, a given user can request and obtain an uplink channel, thereby permitting the user to speak to the group. A given mobile user must have a subscription with the group call service provider in order to be permitted to initiate a group call or speak in a group call.

Group call attributes including, for example, a listing of the cells in which the
30 group call is broadcasted (the group call area) are conventionally compiled in a

-2-

separate network node database, for example the Group Call register (GCR) in GSM networks. The aforementioned network node database is typically associated with a mobile switching exchange, for example a Mobile Switching Center (MSC) in GSM systems. In other words, the database (or register) function is typically distributed and implemented locally on the mobile switching exchanges which control respective service areas (e.g., groups of cells) within the network. Each local database or register holds group call attributes related to the service area controlled by the associated switching exchange.

In order to manage a conventional voice broadcast call (i.e., a group call), one switching exchange is appointed as an anchor exchange. An anchor exchange is typically responsible for managing and maintaining a particular group call. Thus, the anchor exchange implements the broadcasting of the group call in its service area. In situations where the group call area includes cells of a service area (or areas) controlled by another exchange (or exchanges), the anchor exchange (predefined in the network) controls broadcast of the group call within its service area, and also distributes the group call to other exchanges as necessary in order to ensure that the group call is broadcasted to the entire group call area.

Subscribers of conventional group call services are typically allowed to move from cell to cell, while remaining in the group call, assuming that the group call is being broadcasted in each new cell into which the subscriber roams. However, if the group call is not being broadcasted in the new cell, then the group call will no longer be available to the subscriber. Further, changing cells often requires a short interruption of the subscriber's reception of the group call until the subscriber's mobile terminal has listened to the notification channel in the new cell and tuned to the proper group call channel in the new cell.

Some conventional services permit changing from a first cell to a second cell without interruption of an ongoing group call. However, uninterrupted service is provided only if the group call is being broadcasted in the second cell even before the subscriber roams into the second cell. That is, in order to ensure that a given mobile subscriber unit can roam into a neighboring cell without any interruption of a group

-3-

call, all neighboring cells into which the subscriber unit might possibly roam must be broadcasting the group call before the subscriber unit roams there. Thus, in order to provide the possibility for uninterrupted service when roaming into any of the neighboring cells, network resources must be allocated in each neighboring cell, whether or not the user ever roams into any of those cells. Such operation is disadvantageously wasteful of network resources.

Another problem associated with conventional group call services is that the definition of a group and the associated group call area are network parameters. Thus, the group call area, group membership and other conventional group call attributes are defined (e.g., by an operator) at the time that the group is created, and are thereafter fixed. Changes in the existing group membership, group call area and other group call attributes can only be performed with administrative support, such as from the network operator. All users of a given group must disadvantageously dispatch their mobile unit or at least a data storage portion thereof (such as a SIM card in a GSM unit) to the network operator for updating with the proper group information.

In emergency situations, there may be a need to create a certain group instantly in order to manage emergency support. In these situations, there would clearly be no time to rely on administrative support (e.g., from a network operator) to arrange for proper group membership, group attributes and subscriptions. Even in the case of an existing emergency group, only those having a proper subscription are permitted to speak to the group, which is clearly disadvantageous in an emergency, because vital support from a given party could be rendered unavailable if that party does not have a proper subscription.

Also, arranging for a group call having a group call area that overlaps the service areas of plural network operators requires cooperation between the network operators, which disadvantageously adds to the administrative burden of establishing such a group call.

It is desirable in view of the foregoing to provide group call services without the aforementioned disadvantages associated with conventional group call services.

-4-

According to the present invention, the user of a mobile terminal can advantageously establish a group call immediately when needed. Further according to the invention, the group call area associated with a given group call can be dynamically modified during the group call to accommodate changes in the location of group members connected to the call. Further according to the invention, group calls can advantageously be conducted among group members without any of the group members having a group call services subscription with the network operator. Further according to the invention, a user (or an application program) can, dynamically and on demand, establish, modify or delete group call attributes.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a block diagram of an exemplary communications system according to the present invention.

FIGURE 2 illustrates in more detail an exemplary cell of FIGURE 1.

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FIGURE 3 illustrates pertinent portions of an exemplary embodiment of the service node of FIGURE 1.

FIGURE 4 illustrates exemplary operations whereby a user of a mobile station can create a group for purposes of making a group call according to the invention.

FIGURE 5 illustrates in more detail a portion of the exemplary information storage portion of FIGURE 3.

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FIGURE 6 illustrates exemplary operations that can be executed by the communications system of FIGURE 1 when the user of a mobile terminal requests connection to a group call.

FIGURE 7 illustrates exemplary operations which can be executed by the communications system of FIGURE 1 when a user of a mobile station wishes to speak in a group call.

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FIGURE 7A illustrates exemplary operations which can be executed by the communications system of FIGURE 1 when a user of a mobile station urgently wishes to speak in a group call.

-5-

FIGURE 8 illustrates exemplary operations which can be performed by the communication system of FIGURE 1 when a mobile station that is connected to a group call moves from one cell to another.

5 FIGURE 8A illustrates exemplary operations which can be performed in conjunction with those of FIGURE 8, but which additionally permit a mobile terminal to change cells without losing contact with a group call.

FIGURE 9 illustrates exemplary operations which can be alternately performed in conjunction with operations of FIGURES 6 and 8.

10 FIGURE 10 diagrammatically illustrates a relationship between a group title, a group ID and neighborhoods according to the invention.

FIGURE 11 illustrates exemplary operations which can be performed by the communication system of FIGURE 1 to delete a cell from a group area according to the invention.

15 FIGURE 12 illustrates the data structure of an exemplary group call register according to the invention.

FIGURE 13 illustrates a data structure of another exemplary group call register embodiment according to the invention.

20 FIGURE 14 illustrates exemplary operations which can be performed by the communication system of FIGURE 1 in order to implement a "moving" group call area.

FIGURE 15 illustrates examples of location oriented groups according to the invention.

FIGURE 16 illustrates exemplary operations which can be performed by the communication system of FIGURE 1 to permit a group member to set up a group call.

25 FIGURE 17 illustrates exemplary operations which can be performed by the communication system of FIGURE 1 when a traveler requests connection to a location oriented group call for travelers.

30 DETAILED DESCRIPTION

-6-

The present invention provides a service node having at least one subscription with a network operator providing a voice broadcast call service. A further characteristic of the present invention is that the service node has a data connection to a network administrative system for administration of voice broadcast call data allowing the service node to retrieve and modify certain broadcast call data. Broadcast call data can be defined or modified in response to actions taken by broadcast call group users. For example, a mobile user may interrogate the system, according to the invention, about which groups have been registered at the service node and request connection to any selected group regardless of whether or not the user is in a cell already included in the group call area. In response to such a request, the system of the present invention may add the cell to the group call area.

A closed group is herein defined as a group of identified persons who are allowed to communicate in a broadcast group call. Connection to such a group may require a password. Further, the concept of an open group is defined herein. Generally, an open group is open to anyone requesting to be connected. For example, a Subject Oriented Open Group relates to a group having a common interest in a certain subject. Users may connect to the group from any place within reach of a base station of a mobile telecommunications system. A second type of open group, a Location Oriented Open Group, is related to a geographical area. The group call area of a Location Oriented Open Group may, e.g., be defined to comprise the current cell of the initiating group call user and, in addition, a certain neighborhood of adjacent cells. The group call area can thus follow the path of a moving user. The primary use of such groups would be in emergency situations to request support from other nearby users. The situation may occur that a user, having initiated such a location dependent group, is moving into a new environment in which there is already another location dependent group. The method, according to the present invention, gives priority to the first group of the kind in the area. Therefore, a user moving into an area where there is already a location dependent group, will close its own group and connect to the existing group. Thus, the user having first created a location dependent group in a certain area will be called the primary user, and his group will have preference over

-7-

other groups moving into the area. If the primary user leaves an area in which there are remaining users, a new host (i.e., new primary user) must be assigned to the group call in that area. The system, according to the present invention, will then broadcast a message requesting someone to register as host for the group. If no host registers, the system deletes the group call. A primary user moving into a new area in which there is not any previous location dependent group, will request a new location dependent group and register as primary user.

According to the present invention, the connection to a group call is administered by the service node. Thus, if a user has decided to connect to a selected group call, e.g., a closed group, a first connection is established with the service node whereby a dialogue is initiated with the user. The user may be prompted for a password to be allowed access to the group call. In response to a successful verification of the password, the service node provides the user with the group ID which is used for retrieving the network broadcast of the group call. The user's mobile terminal stores the group ID.

Similarly, at a cell change, the service node participates and supports the user's changeover process to avoid disturbances in the user's connection to an ongoing group call. When the mobile terminal detects a need to perform handover, it can establish a normal duplex connection with the service node and provide the group ID, whereupon the service node can bridge a connection to the group call. This connection will provide an undisturbed connection to the group call following normal network routines for soft handover. The connection is released when the mobile terminal has detected the group call notification in the new cell and tuned to the new channel. The mobile terminal may, e.g., listen to the notification channel while in dedicated mode. When the group ID of the ongoing group call is detected, the mobile reads the channel description and tunes to the new channel. The duplex connection with the service node may thereafter be released.

FIGURE 1 illustrates diagrammatically an exemplary communication system implementing the present invention. The communication system of FIGURE 1 includes a mobile cellular telephone network 11 which can be coupled at 12 for

-8-

conventional signaling and voice traffic with one or more of a public switched telephone network PSTN, an IP network carrying voice communications VOIP, and a private fixed network PTN. A service node SN is coupled at 19 for conventional signaling and voice traffic with the cellular telephone network 11, and is coupled at 5 15 for conventional signaling and voice traffic with one or more of VOIP, PSTN and PTN. The service node is further coupled at 17 for conventional signaling with a group call manager (GCM) that is coupled at 14 and 16 for conventional signaling with the cellular telephone network.

The cellular telephone network 11 includes a plurality of mobile switching 10 exchanges MX, which control operations in respective pluralities of cells within the cellular network. The mobile exchanges are coupled for signaling and voice traffic with one another and with the respective pluralities of cells that they control. This general architecture of a mobile cellular telephone network is well known in the art. For example, the Mobile Switching Centers (MSC) in a GSM cellular network are 15 exemplary of the mobile exchanges MX of FIGURE 1.

In some embodiments, referred to herein as "network-integrated" embodiments, the service node SN can be integrated into network 11. For example, as will be apparent from the following description, the functionality of the service node can be integrated into one of the mobile exchanges.

FIGURE 2 diagrammatically illustrates an exemplary cell from FIGURE 1. 20 In the exemplary cell of FIGURE 2, a fixed-site radio transceiver 21 communicates with a plurality of mobile stations (MS) 23 via a radio interface 22. In a GSM network, for example, a base transceiver station (BTS) is exemplary of the fixed-site transceiver 21 of FIGURE 2. The transceiver 21 is coupled at 25 to the controlling MX for conventional signaling and voice traffic therebetween.

Returning now to FIGURE 1, the group call manager GCM is coupled by signaling channels 14 to a plurality of group call registers GCRs, and is coupled by signaling channel 16 to a home location register HLR. The signaling channels at 14 and 16 can be, for example conventional SS7 signaling channels. The group call 30 manager, as will be evident from the following description, can be implemented, for

-9-

example, as a network function in one of the mobile exchanges. The group call registers GCRs can be, for example, distributed among and co-located with the mobile exchanges MXs (see broken lines in FIGURE 1), as is typical in conventional GSM networks. The signaling in the signaling channels at 14 and 16, as well as in the
5 signaling channels at 17 and 19 (which can also be, for example, SS7 signaling channels) can be performed according to any suitable conventional signaling format, for example MAP (Mobile Application Part) signaling as used in GSM networks.

The service node SN has computing and switching capabilities, and can, for example, be integrated with a PABX. The service node preferably has at least one
10 identity in the PSTN, whereby the service node can be accessed through a voice connection. The service node can also be accessed from the VOIP or the PTN, or from the cellular network 11 (via one of PSTN, PTN and VOIP). The service node SN acts as a dispatcher towards a voice broadcast service offered by the cellular network 11. Thus, the service node preferably has a plurality of conventional
15 subscriptions in the cellular network allowing the service node to set up conventional group calls (including several group calls simultaneously) towards the mobile stations 23 operating in the cellular network. The group call registers GCR store group call attributes corresponding to each group.

FIGURE 3 illustrates pertinent portions of an exemplary embodiment of the
20 service node SN of FIGURE 1. In particular, the example service node of FIGURE 3 includes a controller 31, an information storage portion 33 and a switching portion 35. The controller 31 is coupled for communication with the information storage section 33, and is also coupled to the switching portion 35 to control operations thereof. The controller 31 is further coupled at 17 for signaling with the group call
25 manager GCM, and at 19 for signaling with one of the interconnected mobile exchanges MX (see FIGURE 1). The controller 31 is also coupled at 15 for signaling with one or more of the networks VOIP, PSTN and PTN of FIGURE 1. The switching portion 35 is coupled at 19 to one of the interconnected mobile exchanges MX (see FIGURE 1) for voice traffic with the mobile exchange, and is also coupled
30 at 15 for voice traffic with one or more of VOIP, PSTN and PTN. The signaling

-10-

connections at 15 and 19 permit the controller 31 to arrange for desired calls to be connected to switching portion 35 via the voice connections at 15 and 19. The functionality and operation of the service node portions illustrated in FIGURE 3 are explained in further detail below.

5 FIGURE 4 illustrates exemplary operations according to the invention whereby a user of a mobile station can create a group for purposes of making a group call. First, the mobile station user makes a call to the service node. The user can indicate to the service node that a group is to be created by using a special directory number or a directory number in combination with a code. The code can indicate, for
10 example, that the group is to be a closed group consisting of a predetermined set of identified persons, or an open group which can be joined by any mobile station user as desired. Alternatively, the mobile station user in FIGURE 4 can use signaling, for example DTMF tones, to specify whether the group is to be a closed group or an open group. The above-described request to create a group is illustrated diagrammatically
15 at 41 in FIGURE 4. Signaling between the mobile station and service node according to the invention can be accomplished using e.g., a conventional data connection, user-to-user signaling (e.g., according to GSM Standard 02.87), Short Message Service (SMS), or a mobile packet data service.

 At 42 in FIGURE 4, the service node SN determines, in a dialogue with the
20 user, a user group title (e.g., specified by the user) and, if required (e.g., for a closed group), a password. The group title can subsequently be used as a short name for the group in user interrogations of and/or announcements by the service node. Also during the dialogue 42, the user may indicate whether or not group calls shall be encrypted (for a closed group).

25 The service node allocates to the calling user one of its voice broadcast service subscriptions in the cellular telephone network. In the example of FIGURE 4, the service node effects this allocation by creating an association between the user group title (and password if applicable) and a group ID conventionally associated with the allocated voice broadcast service subscription. This association of the group call title
30 to the group ID is illustrated at 43 in FIGURE 4. The group ID and, if applicable, a

-11-

group key for encryption are then returned to the user at 45. Thereafter, at 46, the user stores the group ID and, if applicable, the group key in the mobile terminal. For example, the group ID can be stored in the Subscriber Identity Module (SIM) of a GSM mobile terminal according to the GSM Standard 11.14, SIM Application Toolkit. The mobile terminal can maintain a running list of group IDs corresponding to groups to which the mobile terminal belongs. At 47, the group title, and the password as necessary, are distributed, by any suitable communication (e.g., Short Message Service), to the other mobile terminals that will be allowed to (or may wish to in the case of an open group) participate in group calls of the created group.

10 Copending U.S. Serial No. 08/977,070 (Docket No. 34645-242), hereby incorporated by reference herein, discloses a group of users connecting to a meeting by means of a meeting reference. The aforementioned group call title is one example of such a meeting reference.

15 Referring again to FIGURE 3, the initial call from the mobile terminal to request creation of a call group (see 41 in FIGURE 4) can be received by the controller 31 of the service node SN either at 15 via one of the networks VOIP, PSTN or PTN, or at 19 via a mobile exchange MX coupled to the service node. Referring also to FIGURE 5, the information storage portion 33 of one embodiment of the service node includes a list 51 of group IDs corresponding to the voice broadcast call services
20 subscribed to by the service node. When a group call title (and password if applicable) is received from the mobile terminal, it is forwarded from controller 31 to associating logic 53, which associates the group call title (and password if applicable) with one of the group IDs in the list 51, thereby creating a corresponding list 55 of group call titles (and passwords), each entry of which corresponds on a one-to-one
25 basis with one of the group IDs in the list 51. Thus, whenever the controller 31 inputs a group call title to the information storage portion 33, the associating logic 53 either associates one of the group IDs with the group call title (and password if applicable) or, if the group call title has already been associated with a group ID (previously), simply retrieves the corresponding group ID from the list 51. In either instance, the

-12-

information storage portion 33 can return to the controller 31 the group ID associated with the group call title.

FIGURE 6 illustrates exemplary operations that can be executed by the communications system of FIGURE 1 when the user of a mobile terminal requests connection to a group call. In FIGURE 6, a user who wishes to connect to a group call first makes a call to the service node SN. The user can indicate to the service node that connection to a group call is desired by using a special directory number or a directory number plus a code in the same general manner described above. Such a request to connect is illustrated diagrammatically at 61. At 63, the service node SN engages in a dialogue with the calling user to determine the group title, the password (as necessary) and the identity of the cell in which the calling terminal is currently operating. In network-integrated embodiments, the mobile exchange handling the user's request can request the cell identity from the serving fixed-site transceiver, and then forward the cell identity to the service node function (as integrated therein or in another mobile exchange). At 64, the service node SN signals the group call manager to determine whether the cell from which the connection request has been made already exists in the group call area and, if not, to add this cell to the group call area. In order to determine whether the cell is included in the group call area, the group call manager GCM may, for example, interrogate each group call register GCR to determine which cells are currently involved in the group call.

In embodiments where the group call registers are associated with the mobile exchanges, then it is only necessary for the group call manager to interrogate those group call registers associated with mobile exchanges involved in the group call. The anchor mobile exchange can include a record of all mobile exchanges involved in the group call, as is conventional, and this record can be accessed by the group call manager GCM. In other embodiments, the group call manager may itself store information corresponding to each group call area, including a complete list of cells and the mobile exchanges to which the cells belong.

If it is determined at 64 that the cell of the requesting mobile station is not in the current group call area, then at 65 the group call manager can interrogate the home

-13-

location register HLR to determine which mobile exchange is responsible for the cell in which the requesting user is operating, thereby also determining the GCR associated with that cell (in embodiments where the GCRs are co-located with the mobile exchanges). At 66, the group call manager GCM creates a new group call area including the new cell.

At 67, the GCM creates a new broadcast call reference, which includes the group ID and the new group call area, and sends the new broadcast call reference to the service node. The service node at 68 uses the new broadcast call reference to initiate a new broadcast call. The service node SN at 62 connects the new broadcast call (available at 15 or 19 in FIGURES 1 and 3) to the ongoing broadcast call (available at 15 or 19 in FIGURES 1 and 3), whereby the subsequent broadcast call will comprise the new cell as well as the original cells. A conventional conference bridge implemented, for example, by the switching portion 35 of the service node SN, can be used to connect the two broadcast calls.

In network-integrated embodiments, the operations at 61, and 63-65 of FIGURE 6 can be executed, after which the group call manager can update the existing group call area as needed to include the identity of the cell in which the requesting user is operating, as shown at 66A in FIGURE 9. The updating can include adding the cell identity either to the group call manager itself, or to the appropriate group call register.

In network-integrated embodiments that have the GCRs co-located with the MXs, the proper group call register is known, namely the group call register of the MX handling the user's request. If the group call area has been updated at 66A in FIGURE 9, the group call manager GCM thereafter signals at 90 the appropriate mobile exchange to establish a channel in the new cell and to connect the channel to the distribution function of the group call, as shown at 91 in FIGURE 9.

At 69, the service node sends the group ID and group key to the requesting mobile terminal, where they are stored at 60. At this point, the requesting mobile terminal can use the group ID (and group key as needed) to listen to the group call.

If it is determined at 64 that the cell of the requesting mobile station is already included in the group call area, then the service node can transmit the group ID and

-14-

group key (as needed) to the mobile terminal at 69, without execution of the actions at 65-68.

FIGURE 7 illustrates exemplary operations which can be executed by the communications system of FIGURE 1 when a user of a mobile station wishes to speak in a group call. A user who wishes to speak to the group first makes a data connection to the service node SN using a special directory number, or a special directory number in combination with a code, indicating a request to speak. This is illustrated at 71 in FIGURE 7. At 73, the service node SN conducts a dialogue with the requesting terminal to obtain from the terminal the group ID of the group to which the calling user is connected and the cell identity of the cell in which the calling user is currently operating. (Conventional networks such as GSM provide the terminal with cell identity information when, for example, the terminal connects to the network or performs a cell change). Thereafter, as indicated at B and C in FIGURES 6 and 7, the above-described actions at 64-68 and 62 in FIGURE 6 (and including the alternate actions of FIGURE 9 for network-integrated embodiments) can be executed as needed. Thereafter, the service node SN can place the requesting user in a speaker queue (if other speakers are waiting also), as shown at 75. When it is the requesting user's turn to speak, the service node SN establishes at 77 a conventional duplex voice connection with the mobile terminal of the requesting user. Then at 79, the service node SN connects the group call to the voice connection established at 77, and thereafter at 78 indicates that the requesting user is ready to speak to the group via the uplink connection.

Referring again to FIGURE 3, once the requesting user has advanced to the head of the speaker queue (implemented, for example, by a pointer in the controller 31 pointing to successive memory locations in the information storage portion 33), the controller 31 can signal appropriately at 19 to establish at 15 or 19 the duplex voice connection from switching portion 35 to the requesting user, and thereafter output appropriate control signals to the switching portion 35 to cause the switching portion 35 to connect the voice connection to the group call, which can easily be made

-15-

available to the switching portion 35 (at 15 or 19) as part of the distribution function of the group call.

Once the voice connection 77 has been connected to the group call at 79, the mobile station of the requesting user can speak to the group via the uplink voice connection and can listen to the group call on the downlink of the voice connection
5 (rather than on the listening channel allocated to the group broadcast call).

In one embodiment, if a user of a mobile terminal urgently requests immediate access to speak during an ongoing broadcast group call, the service node SN can connect that user to the ongoing broadcast call by means of a conventional conference
10 bridge which can be implemented, for example, by the switching portion 35 of FIGURE 3. With this use of a conference bridge, two callers (or more, depending on the capacity of the conference bridge and system parameters) can talk simultaneously to the group during the group call. This use of a conference bridge is illustrated in FIGURE 7A.

15 In FIGURE 7A, operations proceed from point C in FIGURES 6 and 7. Unlike FIGURE 7, however, the speaker queue is not implemented in FIGURE 7A. Rather, the duplex voice connection is established immediately at 77, and is connected to the group call via conference bridge at 74.

FIGURE 8 illustrates exemplary operations which can be performed by
20 embodiments of the communication system of FIGURE 1 when a mobile station that is connected to a group call moves from one cell to another. At 81 in FIGURE 8, the mobile station detects the upcoming cell change. The mobile station makes a temporary connection to the service node SN, for example by an ordinary duplex channel, using a special directory number or a directory number combined with a code
25 that indicates the upcoming cell change. At 82, the terminal uses the temporary connection to transfer to the service node SN the group ID and the new cell identity. The service node SN conducts at 83 a dialogue with the group call manager to determine from the new cell identity whether the new cell is within the group call area of the subject group call. If so, the service node SN need take no further action,

-16-

because the mobile terminal will be able to detect the group ID on the notification channel in the new cell, and tune to the new group call channel as illustrated at 89.

On the other hand, if the new cell is not within the group call area, then at 84 the group call manager interrogates the home location register HLR to identify the mobile exchange MX that controls the new cell, and (in one embodiment) the co-located group call register. At 85, the group call manager creates a new group call area including the new cell. At 86, the group call manager creates a corresponding new broadcast call reference and sends it to the service node. The service node at 87 directs the GCM to initiate a new group call using the new broadcast call reference.

The service node SN at 88 connects the new broadcast call (available at 15 or 19 in FIGURES 1 and 3) to the ongoing broadcast call (available at 15 or 19 in FIGURES 1 and 3), whereby the subsequent broadcast call will comprise the new cell as well as the original cells. A conventional conference bridge implemented, for example, by the switching portion 35 of the service node SN, can be used to connect the two broadcast calls. Once these two broadcast calls have been connected at 88, the service node SN need take no further action, because the mobile terminal can detect the group ID on the notification channel in the new cell and tune to the new group call channel in the new cell, as illustrated at 89.

In network-integrated embodiments, the actions at 81-84 in FIGURE 8 can be executed, after which the group call manager can update the existing group call area to include the identity of the cell in which the requesting user is operating (shown at 66A in FIGURE 9), and thereafter signal the appropriate mobile exchange (shown at 90 in FIGURE 9) to establish a channel in the new cell and connect the channel to the distribution function of the group call (shown at 91 in FIGURE 9).

In another embodiment, the service node SN makes it possible for the mobile terminal to change cells without loss of contact with the group call, which loss of contact can occur using the procedures associated with FIGURE 8. In this embodiment, illustrated in FIGURE 8A, the service node SN connects the ongoing group call (at 15 or 19) to the existing downlink connection (at 15 or 19) between the service node SN and the mobile terminal (e.g., the downlink connection of the duplex

-17-

channel established to notify SN of the upcoming cell change) through a conference bridge implemented, for example, in the switching structure 35 of the service node SN. This permits the user to listen to the group call via the downlink service node connection. As indicated at D and E in FIGURES 8 and 8A, the above-described
5 actions at 83-88 can then be conducted as needed.

In the embodiment of FIGURE 8A, the mobile terminal moving into a new cell has an established point to point connection with the service node SN. Accordingly, an initial notification of the voice broadcast call in the new cell may be transmitted by the corresponding fixed-site transceiver on a suitable signaling channel, e.g., the
10 FACCH channel of a GSM system. As a matter of fact, according to the GSM Standard ETSI 03.69, an initial notification message is sent on FACCH to all ongoing point to point calls in the cell. As an option, the mobile terminal may be arranged such as to listen to the notification channel while connected to the service node SN in order to be notified of voice broadcast calls in the cell.

15 The mobile terminal uses the uplink at 801 to notify the service node SN when the terminal has retrieved and tuned to the group channel (see 89). In response to the notification at 801, the service node at 802 releases the duplex channel on whose downlink the terminal had previously listened to the group call.

If, in the embodiment of FIGURE 8A, the new cell is already in the group call
20 area, then the actions at 84-88 (from FIGURE 8) are not needed. The service node waits for the mobile terminal to tune to the group call channel (89) and provide notification thereof (801), and then releases the duplex channel (802).

As described above, the present invention provides for dynamically adding cells to the group call area in conjunction with movement of group members from cell
25 to cell. Thus, the size of the group call area can be successively increased by addition of new cells. However, it may also occur that some cells in which group members were previously located are no longer occupied by any of the group members due to movement of the group members. In such cases, broadcasting the group call into these cells would waste network resources.

-18-

According to one network-integrated embodiment of the present invention, each group call register GCR can maintain for each cell associated therewith a counter for maintaining a running record of the number of group members in each cell. Thus, referring to FIGURE 8, when a group member moves from one cell to another, the cell identity of both the old cell and the new cell can be provided by the mobile station at 83, so that the group call manager can receive this information at 85 (see FIGURE 8). The group call manager can then direct the appropriate group call register (or registers) to increment by one the counter which tracks the number of group members in the new cell, and decrement by one the counter which tracks the number of group members in the old cell. Also, if a given group member notifies the service node SN that it is withdrawing from the group (deactivating its group membership), the group member can send its cell identity along with the request to withdraw from the group, and the service node SN can then forward this information to the group call manager, which can in turn direct the appropriate group call register to decrement the counter associated with the cell in which the departing group member is located.

The Group Call Manager, GCM, regularly scans the GCR counters to detect any zero value. If a zero counter value is found, then GCM orders the corresponding cell to be removed from the appropriate table (i.e., the stored list of cells of the group call area).

The above-described operation is illustrated by the example of FIGURE 11. At 110, the new and old cell IDs (for a cell change) or the current cell ID (for a membership deactivation) are determined in a dialogue between the mobile terminal and the service node. The membership deactivation or cell change information is forwarded at 111 from the service node to the group call manager. At 112, the appropriate counter in a group call register can be incremented or decremented, and a cell can be deleted from the group call area as needed.

A mobile terminal that is switched off when located in a first cell and thereafter switched on again when located in a second cell will not affect the counter value associated with the first cell. A first exemplary solution to this problem is to modify the mobile terminal software such that the mobile terminal, as a preparatory

-19-

step before switching off, first connects to the service node SN indicating that the mobile terminal status is being changed to switched off status. SN then orders GCM to decrease the appropriate counter by one. A second exemplary solution (which will also account for a mobile terminal moving into another cell) is based on the fact that a network may obtain knowledge on whether mobile stations are listening in a cell by sending an uplink access request on the voice group call channel downlink when no talking service subscriber is present. A terminal receiving such a request should respond thereto indicating a listening status. Preferably, GCM controls this signaling and the responses thereto. By recording the number of responses received, GCM can set the correct counter values associated with the cell. The method of polling a cell for listening terminals, used in the second solution, comprises a modified network function according to the GSM Standard (e.g., GSM 03.68) which should be apparent to workers in the art.

FIGURE 12 illustrates the data structure of one exemplary embodiment of a group call register GCR according to the invention. The exemplary data structure of FIGURE 12 includes a first part 210 and a plurality of second, link parts 220. The link parts 220 can form a linked chain. The first part 210 includes the group ID, and a type reference 211. The type reference 211 indicates, for example, whether the group is a first type of group whose group call area size can dynamically change to reflect changes in the locations of the group members, or a second type of group whose group call area size is more static, and may be changed only by a group administrator in response to decisions at a service administrative level. The FIGURE 12 data structure example is particularly suited for the first type of group, as will be evident below.

The first part 210 further includes a group call attributes portion 212 and a link reference 213. The link reference 213 points to a link part 220 in a linked chain of link parts 220. The group call attributes portion 212 can include, for example, group call attributes as described above.

The link parts 220 can be used to represent the size of the dynamically changeable group call area. Each link part 220 includes a first link reference 224 by

-20-

which the link part is uniquely identified, and a second link reference 223 which uniquely corresponds to the first link reference of another link part in the linked chain of link parts 220. Each link part 220 also includes a cell reference 221 which uniquely identifies a particular cell of the group call area. In a GSM system, the cell reference can identify the cell according to the pertinent GSM Standard, GSM 08.08. The link part 220 may further include other data such as, for example, a counter portion 222 which indicates the number of group members currently listening in that cell. The counter portion 222 can, for example, be coupled to receive the output of a counter associated with that particular cell. The cell counters can operate in response to signaling from the group call manager GCM as described above.

Each of the second link references 223 corresponds uniquely to a first link reference of another link part in the linked chain of link parts. Thus, as cells are dynamically added to the group call area, corresponding link parts 220 can be added to the chain of link parts, and the associated counter can be set to one, thereby initially accounting for the user that caused the cell to be added. If the value stored in counter portion 222 of a given link part 220 reaches zero, then the cell associated with that particular link part 220 is deleted from the group call area and the link part 220 is deleted from the linked chain. If the value stored in counter portion 222 becomes non-zero, this indicates that a group member is again listening in that particular cell, so the cell can be added to the group call area, and the corresponding link part 220 can be inserted into the linked chain.

The exemplary data structure of FIGURE 12 can of course be duplicated as necessary in a given GCR to accommodate plural groups. A similar data structure can also be maintained, as desired, in the group call manager GCM.

FIGURE 13 illustrates another exemplary data structure of a group call register GCR according to the invention, particularly suited for use with the aforementioned second type of group whose group call area size can be changed by a group administrator but does not change dynamically in response to movements of group members. The data structure of FIGURE 13 includes a first part 310, which is similar to the first part 210 of the data structure of FIGURE 12. The first part 310 includes

-21-

the group ID, a type reference 311 and group call attributes 312. Also included is a group call area reference 313 which links the first part 310 to a second part 320. The second part 320 includes a list of records 321, each record including a cell reference (that is, information indicative of the cell identity), and a counter portion 322 coupled to the output of a counter which maintains a running record of the number of group members listening in that particular cell.

The exemplary data structure of FIGURE 13 can be duplicated in a given GCR to accommodate any number of groups. A similar data structure can also be maintained, as desired, in the group call manager GCM.

One example of an open group whose group call area changes according to the location of at least one mobile terminal is herein termed a location oriented open group. Such a location oriented open group can be created by a user, for example a person traveling by sea, to keep in contact with nearby persons in order to be able to get advice about navigation, availability of services, etc. The creation of and connection to such a group can proceed generally as described above. After connecting to the service node SN, the user can receive therefrom a list of available open groups (e.g., a list of group titles). SN may detect, e.g., from the cell identity of the calling terminal, that the terminal is located along a coastal line. The list may therefore contain an open group for sea travelers, exemplary with title "Open group for sea travelers". In other words, the service provider in operation of SN has prepared a group and a title for said purpose, however, initially the group call area is undefined and, consequently, there is no group ID yet assigned to the group. The traveling user would like the group call area to be redefined dynamically, according to the user's location changes, so that there is always a neighborhood of nearby persons. This objective affects the way the group broadcast call system reacts on cell changes. Essentially, the group call area should dynamically be redefined to correspond to the location of at least one terminal having created a neighborhood. For example, a neighborhood can be dynamically redefined as needed to include the current cell of the creating terminal and all cells adjacent thereto. Thus, upon detecting an upcoming cell change, the creating mobile terminal can provide the service node with the target

-22-

cell identity and with the identities of all cells adjacent to the target cell, thus enabling the redefinition of the neighborhood.

The group may, thus, comprise several such neighborhoods. The system must, however, treat each neighborhood separately and broadcast a message only in the relevant neighborhood. This objective is achieved according to a method which will now be described in more detail. The mobile terminal which is first to request a neighborhood causes the service node to assign a group ID to the location oriented open group. Further, the service node creates a group call area corresponding to the neighborhood of the calling terminal. When the terminal connects to the service node with a request to speak, the service node will first check which group call area corresponds to the neighborhood where the terminal is located and second direct a broadcast call into said area. There is, thus, one broadcast call for each neighborhood, identified by its unique broadcast call reference. According to the GSM Standard (e.g., ETSI GSM 03.69), the group call reference is composed of the group ID and the group call area. It may happen that a first neighborhood overlaps with a second neighborhood. A call initiated from the first neighborhood will then comprise the first neighborhood but only that part of the second neighborhood which overlaps with the first neighborhood.

FIGURE 10 shows the relationship between group title, group ID, and neighborhoods. The group title is a common name for a type of location oriented open group. The group ID is assigned at the first registration of a neighborhood and thereafter used for all subsequent registrations of neighborhoods. Each neighborhood corresponds to a group call area. The service node administers all relations between these entities.

Not all users need to or want to create their own neighborhood. Some users may register to the location oriented open group to use any already existing neighborhood. However, if such a user is moving into an area where there is no previous neighborhood, the possibilities will be lost to contact neighboring users. The service node may, in such a case, offer the user a possibility to create a neighborhood

-23-

at the time the user registers to the service node the cell change which brings him out of the current neighborhood.

FIGURE 14 illustrates one example of the updating (i.e., moving) of a location oriented group call area (i.e., neighborhood) as the mobile terminal moves to a new cell. The example refers to the case when the terminal has registered a neighborhood. In FIGURE 14, after the cell change is detected at 81 (similar to FIGURE 8), a dialogue (similar to that at 82 in FIGURE 8) is conducted between the mobile terminal and the service node at 82A. In the dialogue at 82A, the mobile terminal can provide the service node with the identity of the target cell and the identities of all cells adjacent to the target cell. The group ID and terminal identity is also provided to the service node at 82A.

At 83A, a dialogue is conducted between the service node and the group call manager, wherein the group call manager receives from the service node the cell identities comprising the updated neighborhood and the group call reference (i.e., group ID and group call area). At 85A, the group call manager creates a new group call area according to the new neighborhood. After the group call area is updated at 85A, operations can proceed at point F, as shown in FIGURE 8.

The embodiment of FIGURE 14 can also be combined with the embodiment of FIGURE 8A, as shown at points D, F and E of FIGURES 8, 8A and 14. In this combination, the dialogue 82A of FIGURE 14 would be substituted for the dialogue 82 in FIGURE 8A.

In the example of FIGURE 15, there are base stations BS1-BS3 with corresponding cells indicated as circles. In this example it is assumed, for simplicity, that a neighborhood consists of one cell only. This assumption shall, however, not limit the scope of the invention. Two traveling users, A and B, each host (by virtue of having created) a voice group in their respective neighborhoods (cells). Other users in these neighborhoods may connect to participate in group calls in the respective neighborhoods. Traveler C in FIGURE 15 has just moved from either cell BS1 or BS3 into cell BS2 (each BS defines a corresponding cell) and interrogates the service node about the existence of a group call. The service node requests cell data from C,

-24-

determines that there is no group host in that cell and thus permits a new group call to be created with C as host.

5 If C, having thus registered as host, moves into another cell, e.g., BS3, the service node, which actively participates in the cell change, determines that there is no host in cell BS2 after the cell change. The service node further determines, by reading a counter (described above), if there are any remaining listeners in the cell and, if so, issues a broadcast message that any user in cell BS2 can register as a host in that cell. Otherwise, the corresponding group call can be deleted by the service node.

10 FIGURE 17 illustrates exemplary operations that can be executed by the communications system of FIGURE 1 when a person traveling on sea requests to be connected to a group call for sea travelers. Initially at 171, the user of the mobile station calls the service node using a directory number or a directory number in combination with a code to indicate that a connection to a group call is desired. The user may indicate, for example, a desire to use already defined group calls covering
15 the location where the calling user is presently located. At 172, the service node conducts a dialogue with the mobile station to determine the cell in which the mobile station is located. This information is used at 173 to determine if there is already a group call of the requested type which covers the cell. The basis for this investigation is a list of group call areas which the service node has already registered for use with
20 the type of group call requested, i.e., group ID. The service node may, at 174, interact with the Group Call Manager, GCM, to get information about cells included in each group call area having said common group ID.

25 At 175, the service node has determined that there is no existing neighborhood defined which covers the location of the calling user and signals this information to the calling user together with a possibility for the user to create its own neighborhood. At 176, the user enters a dialogue with the service node to accept the creation of its own neighborhood and signals the cell ID that is to be the center of the new neighborhood, and the immediate neighboring cells.

-25-

At 177, the service node selects a new group call area reference and creates a record associating the calling terminal with the selected group call area (and group ID). At 178, the service node requests GCM to update the appropriate GCR registers with identities of the cells comprising the new neighborhood.

5 At 179, the service node acknowledges to the calling terminal the creation of a new neighborhood and signals to the mobile terminal the group ID registered for the group call.

10 A user, e.g., a traveler by sea, may now use a Location Oriented Open Group of the kind described above to alert neighboring travelers on an emergency situation to request for support. However, carrying out the remaining communication through the same broadcast call would prevent additional alerts about new upcoming events. It is, therefore, advantageous to be able to switch to a separate broadcast call in which only those travelers participate who will be prepared to offer their support.

15 A user who is prepared to support, responds to the alert by establishing a duplex connection to the service node and, e.g., by using a code, indicates willingness to support in the last alerted incident. According to one embodiment of the invention, the separate duplex connections established by the responding users are connected by the switching portion 35 of the service node in a conference communication. According to another embodiment, the service node creates a new open group of the
20 kind discussed above in relation to FIGURE 6. When the communication channel no longer is needed, the initiating user so indicates to the service node, which can then delete the conference call or the broadcast call, whatever is the case.

25 A broadcast call can be deleted and the corresponding group ID released for use in a new group call. The initiator of the group call requests the service node to delete the broadcast call. In the following exemplary manners, the corresponding group ID can be deleted from all terminals (i.e., group members) having previously stored the group ID.

30 In one embodiment, characterized by being independent of the network, the mobile terminal is arranged to register to the service node after a certain preset time during which the group ID has not been in use (i.e., no corresponding group calls).

-26-

At this registration, the mobile terminal enters a dialogue with the service node whereby the relevance of all group IDs stored by the mobile terminal is verified. The verification is based on a serial number associated with each group ID and stored together with the group ID at the time the terminal first registered as a listener to the group call. If the verification fails, the service node directs the mobile terminal to delete the group ID. For example, a message may be issued from the service node informing the user that the group ID has been deleted. The group ID may not be reused by the service node until after the aforementioned preset time has elapsed since the group call initiator's request to delete the group. A similar registration is performed by a terminal which has been switched off and thereafter switched on again.

In another embodiment, a network function is used whereby the network obtains knowledge about listening terminals in a cell by sending an uplink access request signal on the voice group call downlink channel. Listening mobile terminals acknowledge the signal to announce their presence in the cell and simultaneously reset internal time counters. If a group is deleted, the uplink access request signaling will cease for the deleted group so the time counter will not be reset. At a certain counter value, the mobile terminal will automatically delete the corresponding group ID. Terminals having been switched off or having been out of reach of a base station must, upon being switched on or moving back into range of the base station, register to the service node to verify the group IDs.

FIGURE 16 illustrates exemplary operations that can be executed by the communications system of FIGURE 1 when a member of a group initiates (i.e., sets up) a group call. Initially at 161, the user of the mobile station calls the service node using a directory number or a directory number in combination with a code to indicate that a group call is to be set up. At 162, the service node conducts a dialogue with the mobile station to determine the group ID and the identities of the cells in which the group call is to be broadcast. This information determined during the dialogue 162 is at 163 forwarded from the service node to the group call manager. The group call manager then causes the group call area to be recorded (either in the group call manager itself or in the appropriate group call registers) at 164. The group

-27-

call area can be defined, for example, as only the cell of the calling mobile station, the cell of the calling mobile station and the immediately surrounding or adjacent cells, cells covering various identified locations, or cells covering a geographical area identified by geographical coordinates. The mobile station and/or a connected
5 computer, as described above, can readily translate the aforementioned examples of group call areas into lists of cell identities to be transferred to the service node in the dialogue 162 of FIGURE 16.

After the group call area has been recorded at 164, the group call manager creates a broadcast call reference and sends it to the service node at 165. The service
10 node at 166 uses the broadcast call reference to direct the anchor mobile exchange to initiate the desired group call. Thereafter, at 167 the calling mobile station detects the group ID and tunes to the group call channel. Similarly, at 168, all other members of the group, provided they are located in the cells identified by the calling mobile station at 162, can detect the group ID and tune to the group channels in their respective cells.

15 Although exemplary embodiments of the present invention have been described above in detail, this does not limit the scope of the invention, which can be practiced in a variety of embodiments.

-28-

WHAT IS CLAIMED IS:

1. A method of creating a call group for participation in a group call in at least one mobile telecommunications network, comprising:
 - 5 a mobile terminal (23) informing a service node that creation of a call group having selected characteristics is desired (41);
 - in response to said informing step, the service node automatically assigning an identifier to the desired call group; and
 - 10 providing to members of the desired call group information indicative of the identifier.
2. The method of Claim 1, wherein said informing step includes providing a group call title to be associated with the desired call group (42), wherein said assigning step includes establishing a corresponding relationship between the group call title and the identifier (43), and wherein said providing step includes
15 providing the group call title to members of the desired call group (45).
3. The method of Claim 1, wherein said providing step includes the service node providing the identifier to a member of the desired call group a group.
20
4. The method of Claim 1, wherein the at least one telecommunications network (11) includes a GSM network.
5. A method of controlling a group call in at least one cellular
25 telecommunications network, comprising:
 - a mobile terminal (23) transmitting to a service node a request for network action relative to a group call;
 - in response to the request, the service node automatically initiating establishment of a group call area record including information indicative of at least
30 one cell, in at least one network, in which the group call is to be transmitted (66); and

-29-

the network (11) transmitting the group call in the at least one cell and at least one network.

5 6. The method of Claim 5, wherein said request transmitting step includes the mobile terminal (23) transmitting a request to set up a group call (41), including identifying the at least one cell and the at least one network, and wherein said establishing step includes creating a new group call area record.

10 7. The method of Claim 5, wherein said request transmitting step includes the mobile terminal (23) transmitting a request for connection to an existing group call (61).

15 8. The method of Claim 7, wherein said initiating step includes the service node automatically initiating an update of an existing group call area record (66), including adding to the existing group call area record a cell identity including information indicative of a cell in which the requesting mobile terminal (23) is located, and wherein said group call transmitting step includes extending an existing group call to the cell in which the requesting mobile terminal (23) is located (62).

20 9. The method of Claim 8, wherein said cell identity includes information indicative of at least one of the cell and the network (11) in which the requesting mobile terminal (23) is located.

25 10. The method of Claim 5, wherein said request transmitting step includes the mobile terminal (23) transmitting to the network (11), in which the mobile terminal (23) is operating, a request to speak in an existing group call (71).

30 11. The method of Claim 10, wherein said initiating step includes the service node automatically initiating an update of an existing group call area record, including adding to the existing group call area record a cell identity including

-30-

information indicative of a cell in which the requesting mobile terminal (23) is located, and wherein said group call transmitting step includes extending an existing group call to the cell in which the requesting mobile terminal (23) is located (62).

5 12. The method of Claim 11, wherein said cell identity includes information indicative of at least one of the cell and the network (11) in which the requesting mobile terminal (23) is located.

10 13. The method of Claim 10, including the service node establishing a duplex voice connection (77) with the requesting mobile terminal (23), and the service node thereafter connecting the existing group call to the duplex voice connection (77), and thereafter a user of the requesting mobile terminal (23) listening to the existing group call on a downlink channel of the duplex voice connection and speaking in the group call via an uplink channel of the duplex voice connection.

15 14. The method of Claim 13, wherein said connecting step includes the service node using a conference bridge to connect the duplex voice connection to the existing group call (74).

20 15. The method of Claim 13, including the service node placing the request to speak in a queue (75) with other requests to speak, and permitting the user of the requesting mobile terminal (23) to speak to the group in turn (78).

25 16. The method of Claim 5, wherein said request transmitting step includes the mobile terminal (23) transmitting a request to remain connected to an existing group call during an upcoming cell change anticipated by the mobile terminal (23).

30 17. The method of Claim 16, wherein said initiating step includes the service node automatically initiating creation of a new group call area record (83) such that the group call area record includes a new cell identity including information

-31-

indicative of a new cell that the mobile terminal (23) enters upon execution of the anticipated cell change, and wherein said group call transmitting step includes the network (11), in which the mobile terminal (23) is operating, initiating a new group call based on the new group call area record and including the new cell, and
5 connecting the existing group call to the new group call to create a resultant group call (88).

18. The method of Claim 17, wherein said cell identity includes information indicative of at least one of the cell and the network (11) in which the requesting
10 mobile terminal (23) is located.

19. The method of Claim 17, including the requesting mobile terminal (23) detecting, on a notification channel in the new cell, a notification message including a group identifier (51) associated with the resultant group call and a channel identifier
15 that identifies the channel on which the resultant group call is transmitted in the new cell (89).

20. The method of Claim 16, wherein said request transmitting step includes the mobile terminal (23) establishing a duplex connection with the service
20 node, and including the service node automatically connecting the existing group call to a downlink channel of the duplex connection in response to the request.

21. The method of Claim 20, including, after said connecting step, the requesting mobile terminal (23) detecting, on a notification channel of a new cell that
25 the mobile terminal (23) has entered pursuant to the cell change, a notification message including a group identifier (51) associated with the existing group call and a channel identifier which identifies the channel on which the existing group call is transmitted in the new cell (89), and the requesting mobile terminal (23) thereafter tuning to the channel (801) and indicating to the network (11), in which the mobile
30 terminal (23) is operating, that the requesting mobile terminal (23) has tuned to the

-32-

channel, and thereafter the network (11), in which the mobile terminal (23) is operating, releasing the connection between the existing group call and the downlink channel of the duplex connection (802).

5 22. The method of Claim 21, wherein, after said connecting step and before said detecting step:

 said group call area record establishing step including the network (11) automatically updating an existing group call area record including adding to the existing group call area record the new cell identity including information indicative
10 of the new cell (66A); and

 said group call transmitting step including extending an existing group call into the new cell.

 23. The method of Claim 22, wherein said cell identity includes information
15 indicative of at least one of the cell and the network (11) in which the requesting mobile terminal (23) is located.

 24. The method of Claim 16, wherein said request transmitting step includes the mobile terminal (23) identifying to the network (11), in which the mobile
20 terminal (23) is operating, a first cell which is to be entered upon the upcoming cell change and a second cell which is to be exited upon the upcoming cell change, and the network, responsive to said identifying step, automatically incrementing a number of listeners associated with the existing group call in the first cell and automatically decrementing a number of listeners associated with the existing group call in the
25 second cell (112).

 25. The method of Claim 24, including, after said decrementing step, the network (11) deleting the second cell from the group call area record if the number of listeners associated with the existing group call in the second cell is zero (112).

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-33-

26. The method of Claim 16, wherein said request transmitting step includes the mobile terminal (23) identifying to the network (11), in which the mobile terminal (23) is operating, a first cell which will be entered by the mobile terminal (23) upon the upcoming cell change and at least one cell adjacent to the first cell (82),
5 said establishing step including the network (11), in which the mobile terminal (23) is operating, automatically creating a new group call area record including the at least one cell.

27. The method of Claim 5, wherein the at least one telecommunications
10 network (11) includes a GSM network.

28. The method of Claim 5, wherein said establishing step includes the network (11) automatically accessing an existing group call area record and determining whether the existing group call area record is to be changed in response
15 to the request (85A).

29. An apparatus that supports creation of a call group for participation in a group call in at least one mobile telecommunications network, comprising:
an input for receiving from a mobile terminal (23) information indicative of
20 a desire to create a call group having selected characteristics;
logic (53) coupled to said input and responsive to said information for automatically assigning an identifier to the desired call group;
an output for providing the identifier to the mobile terminal (23) and for providing to members of the desired call group information indicative of the identifier;
25 and
an output for initiating at the network (11) a group call having the selected characteristics and identifiable by the identifier.

30. The apparatus of Claim 29, wherein the at least one
30 telecommunications network (11) includes a GSM network.

-34-

31. An apparatus for controlling a group call in at least one cellular telecommunications network, comprising:

an input for receiving from a mobile terminal (23) a request for network action relative to a group call;

5 a data storage apparatus coupled to said input and responsive to said request for automatically establishing a group call area record including information indicative of at least one cell in which the group call is to be transmitted.

32. The apparatus of Claim 31, wherein said group call area
10 record includes information indicative of a cell identity of at least one mobile terminal (23) participating in the group call.

33. The apparatus of Claim 32, wherein said cell identity includes information indicative of at least one of the cell and the network (11) in which the requesting
15 mobile terminal (23) is located.

34. The apparatus of Claim 31, wherein said request is a request to set up a group call (41).

20 35. The apparatus of Claim 31, wherein said request is a request to connect to an existing group call (61).

36. The apparatus of Claim 31, wherein said request is a request to speak in an existing group call (71).

25 37. The apparatus of Claim 31, wherein said request is a request to remain connected to an existing group call during an upcoming cell change anticipated by the mobile terminal (23).

-35-

38. The apparatus of Claim 31, wherein the at least one telecommunications network (11) includes a GSM network.

39. A data storage apparatus for storing information associated with a group call in at least one mobile telecommunications network, comprising:

a plurality of data storage parts (33) which respectively correspond to cells in which a group call is transmitted, said cells defining a group call area of the group call; and

each said data storage part (33) having stored therein first link reference information (224), and each said data storage part (33) having stored therein second link reference information (223), said second link reference information (223) of each said data storage part (33) uniquely corresponding to said first link reference information (224) stored in another of said data storage parts (33).

40. The data storage apparatus of Claim 39, wherein said plurality of data storage parts (33) correspond to cell identities of mobile terminals(23)s participating in the group call.

41. The data storage apparatus of Claim 40, wherein said cell identities include information indicative of at least one of the cell and the network (11) in which the requesting mobile terminal (23) is located.

42. The data storage apparatus of Claim 39, wherein each of said data storage parts (33) includes a counter having an input for receiving from the network information indicative of movements of group members into and out of the corresponding cell, said counter operable to increment in response to movement of a group member into the corresponding cell, and operable to decrement in response to movement of a group member out of the corresponding cell.

-36-

43. The apparatus of Claim 39, wherein the at least one telecommunications network (11) includes a GSM network.

44. A data storage apparatus for storing information associated with a group call in at least one mobile telecommunications network, comprising:

a plurality of data storage portions (33) which respectively correspond to cells in which a group call is transmitted, said cells defining a group call area of the group call;

each said storage portion (33) including a counter part (222) for storing therein information indicative of a number of listeners currently participating in the group call from within the corresponding cells; and

an input for receiving from the network (11) information indicative of movements of group call listeners into and out of the cells of the group call area, said input coupled to said counter portions (222) for permitting the listener information stored in each counter portion (222) to be updated automatically in response to movements of listeners into and out of the corresponding cell.

45. The data storage apparatus of claim 44, wherein said plurality of data storage portions (33) correspond to cell identities of mobile terminals (23) participating in the group call.

46. The method of Claim 45, wherein said cell identities include information indicative of at least one of the cell and the network (11) in which the requesting mobile terminal (23) is located.

25

47. The apparatus of Claim 44, wherein the at least one telecommunications network (11) includes a GSM network.

48. A method of creating a call group for participation in a group call in at least one mobile telecommunications network, comprising:

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-37-

a mobile terminal (23) informing a service node that creation of a call group having selected characteristics is desired;

in response to said informing step, the service node, associated with at least one operator, automatically determining group call setup parameters;

5 ordering at least one network (11) to establish at least one group call using said characteristics; and

said service node returning to the calling mobile terminal (23) defining parameters enabling the mobile terminal (23) to connect to said established group call.

10 49. The method of Claim 48, wherein said informing step includes providing the service node with a list of available networks, and wherein said determining step includes selecting at least one network (11) from said list.

15 50. The method of Claim 48, wherein the at least one telecommunications network (11) includes a GSM network.

51. An apparatus that supports creation of a call group for participation in a group call in at least one mobile telecommunications network, comprising:

20 an input for receiving from a mobile terminal (23) information indicative of a desire to create a call group having selected characteristics;

logic coupled to said input and responsive to said information for automatically determining group call setup parameters and for automatically ordering at least one network (11) to establish at least one group call using the selected characteristics;

25 an output for returning to the mobile terminal (23) defining parameters enabling the mobile terminal (23) to connect to said established group call; and

an output for initiating at the network (11) a group call having the selected characteristics.

-38-

52. The apparatus of Claim 51, wherein the at least one telecommunications network (11) includes a GSM network.

1/10

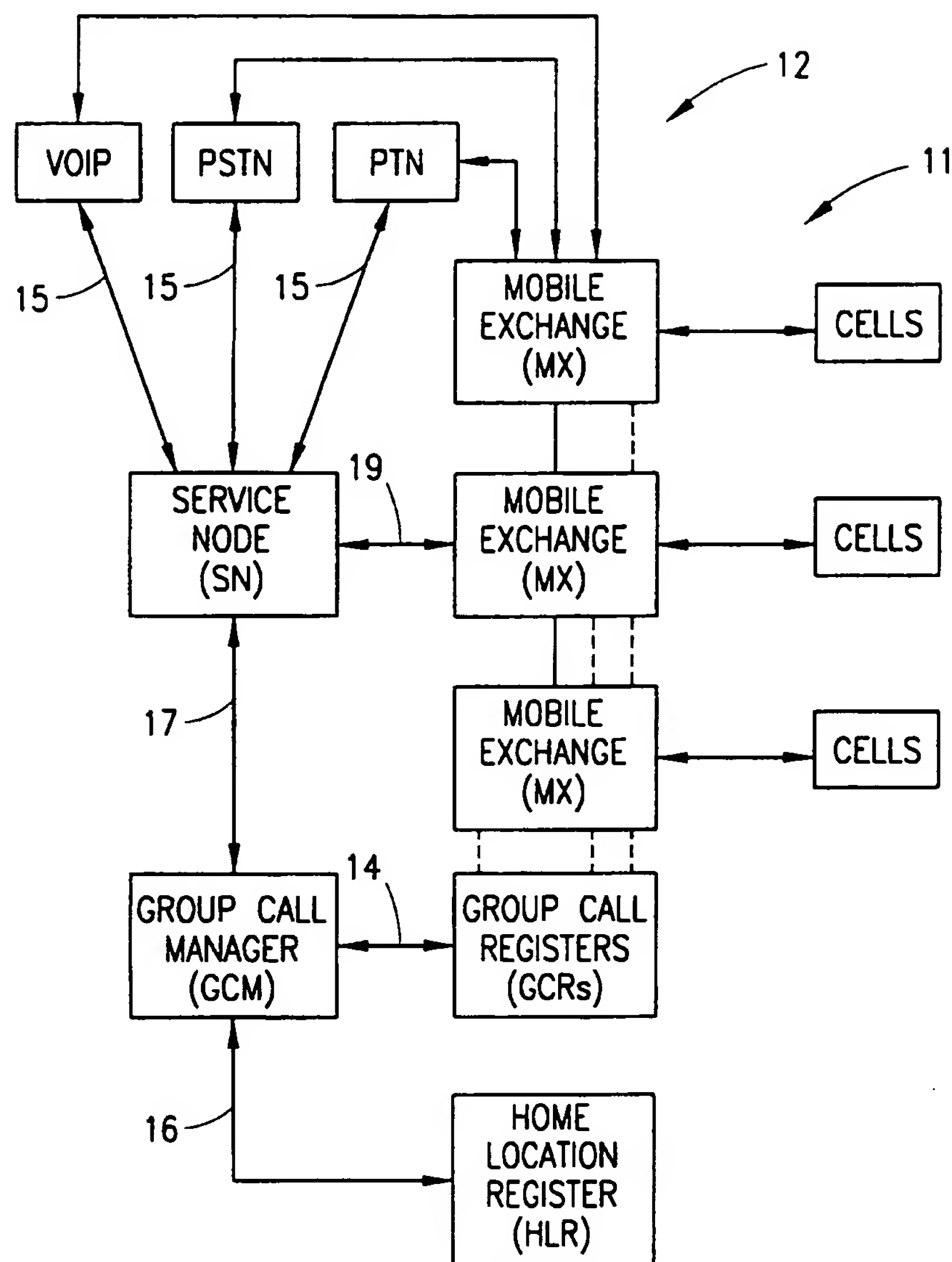


FIG. 1

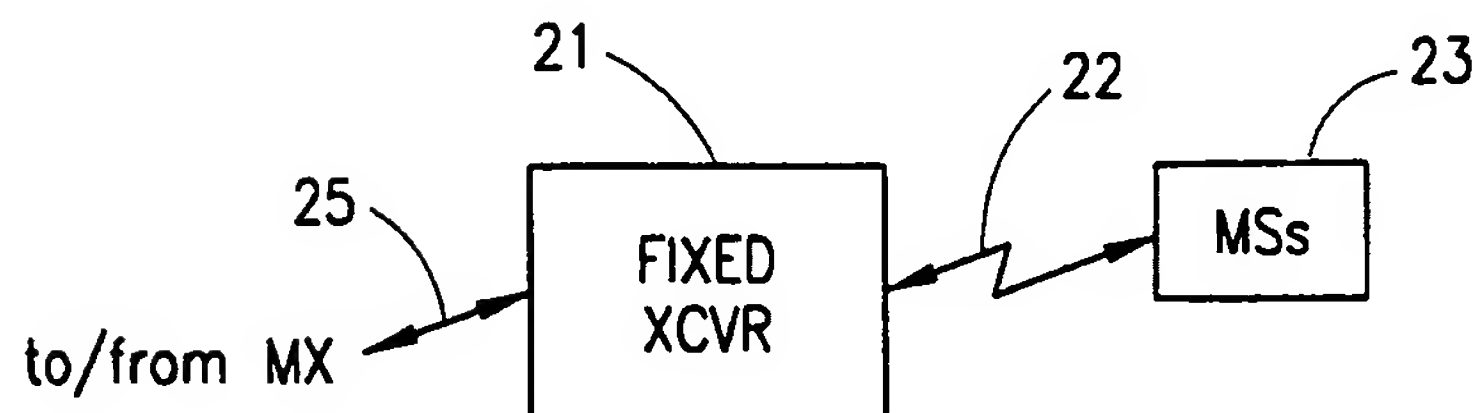


FIG. 2

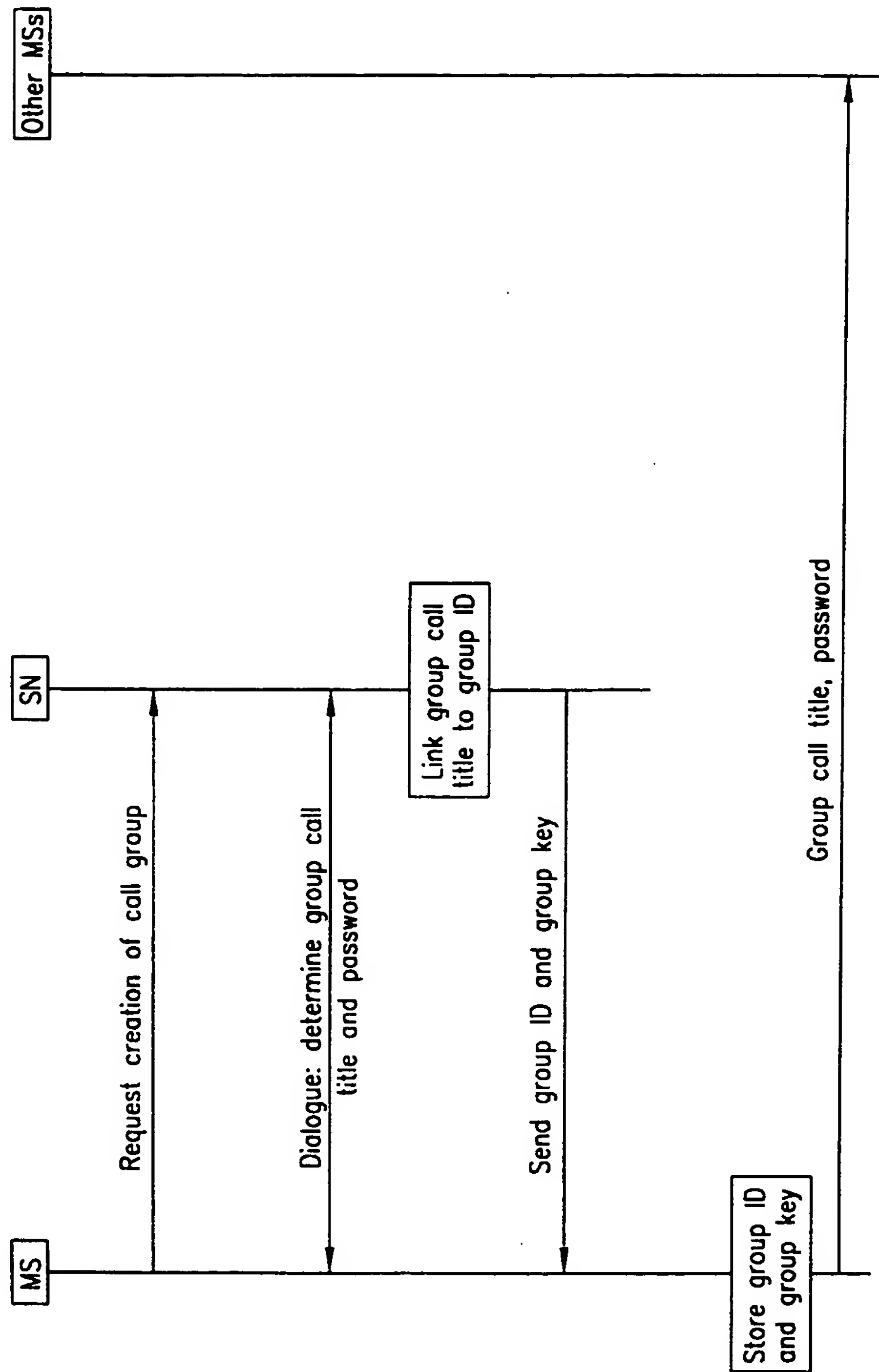
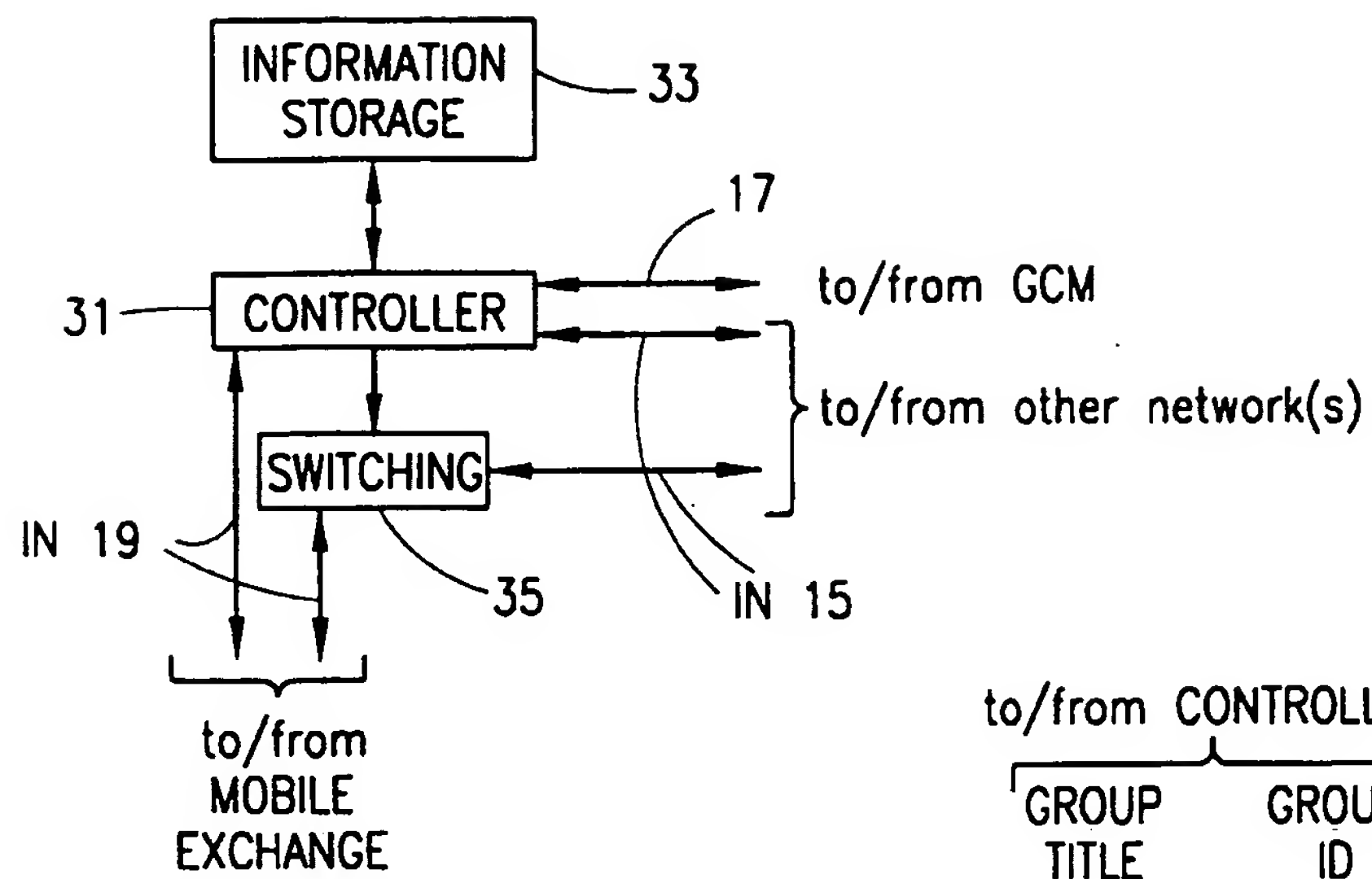
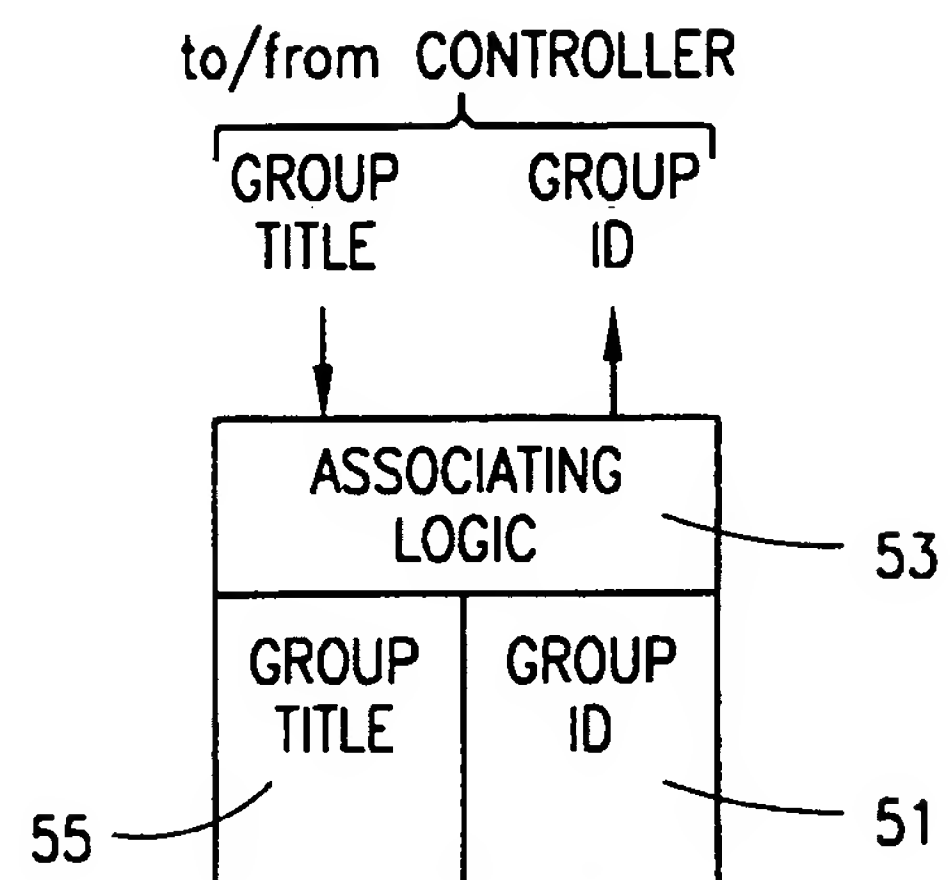


FIG. 4

3/10

**FIG. 3****FIG. 5**

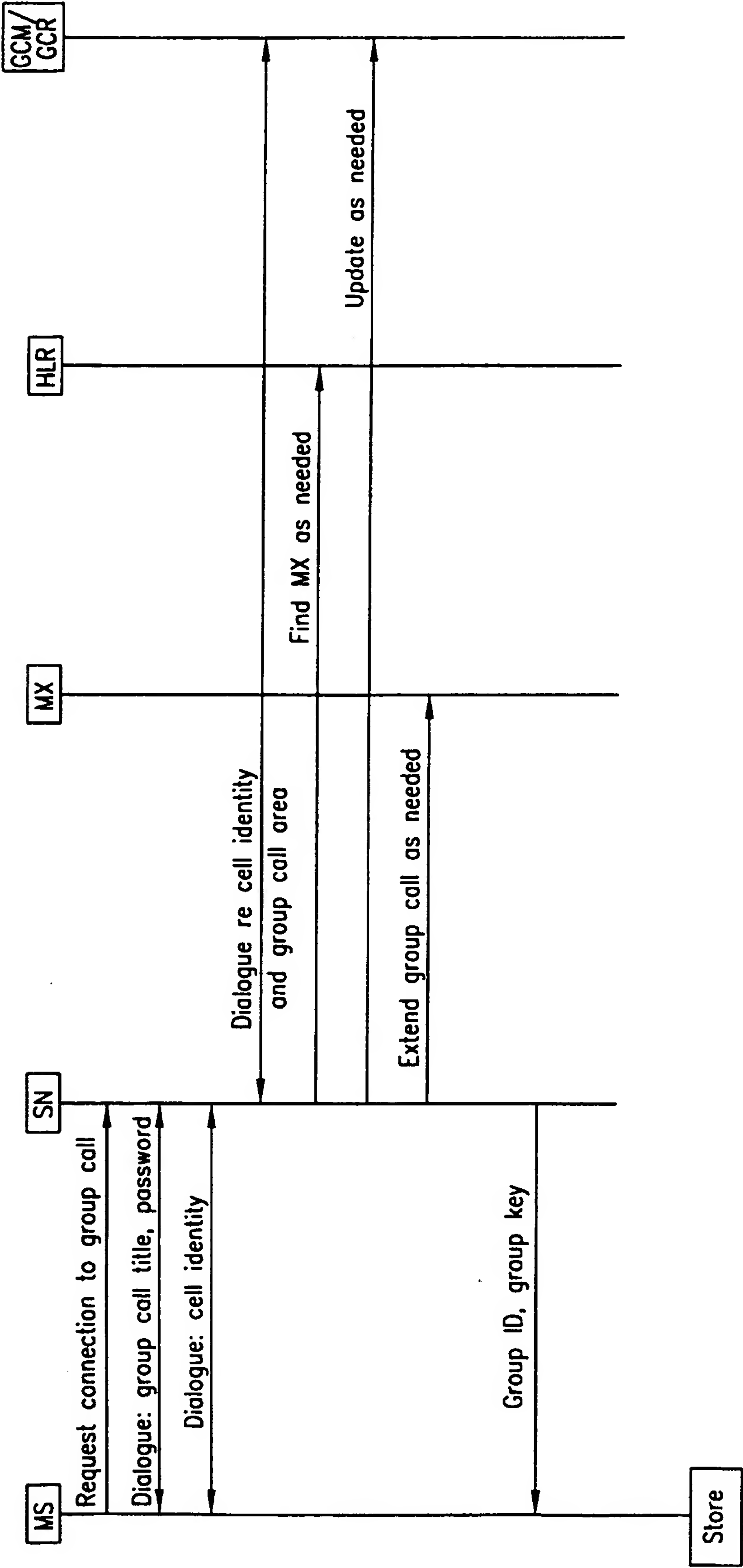


FIG. 6

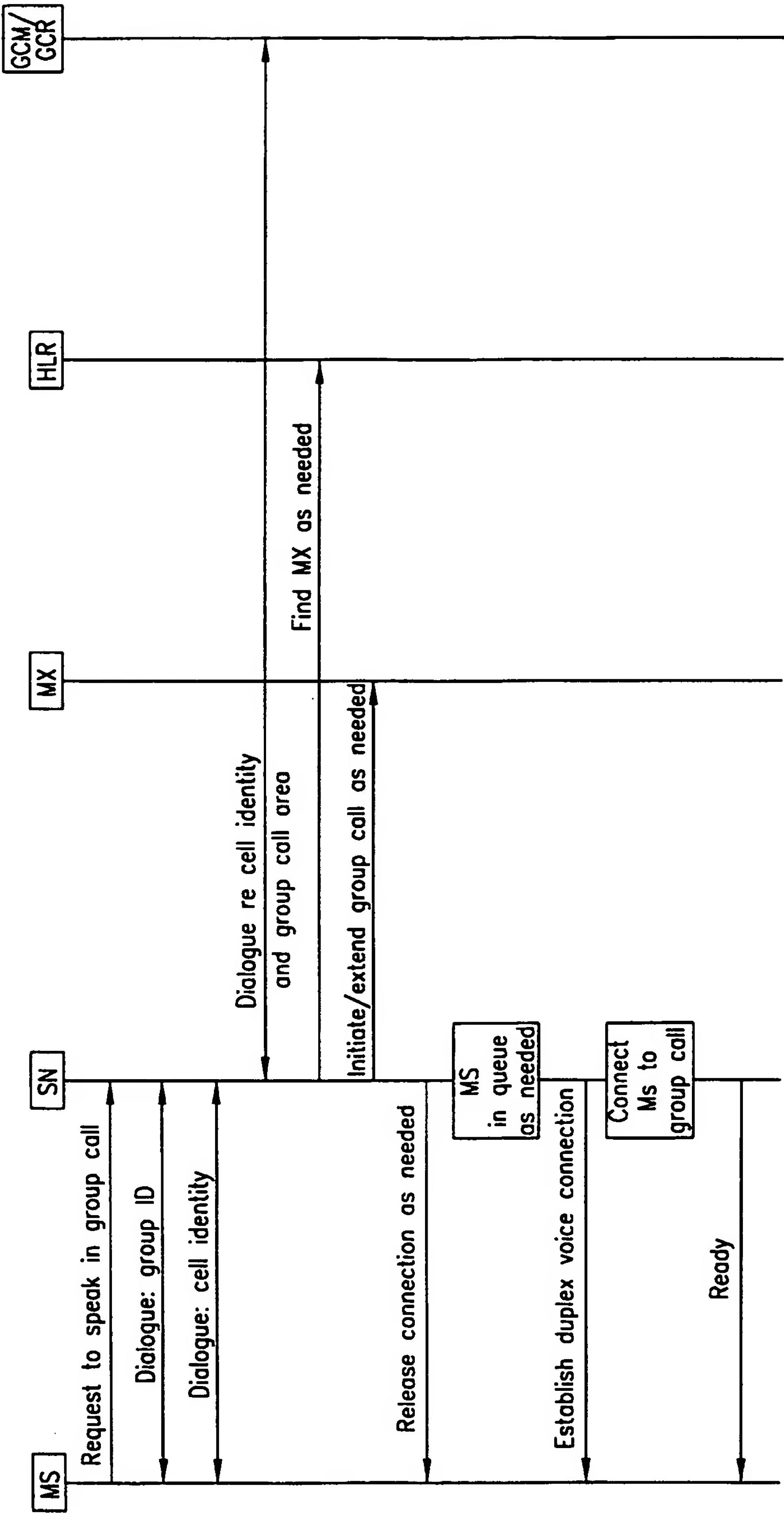


FIG. 7

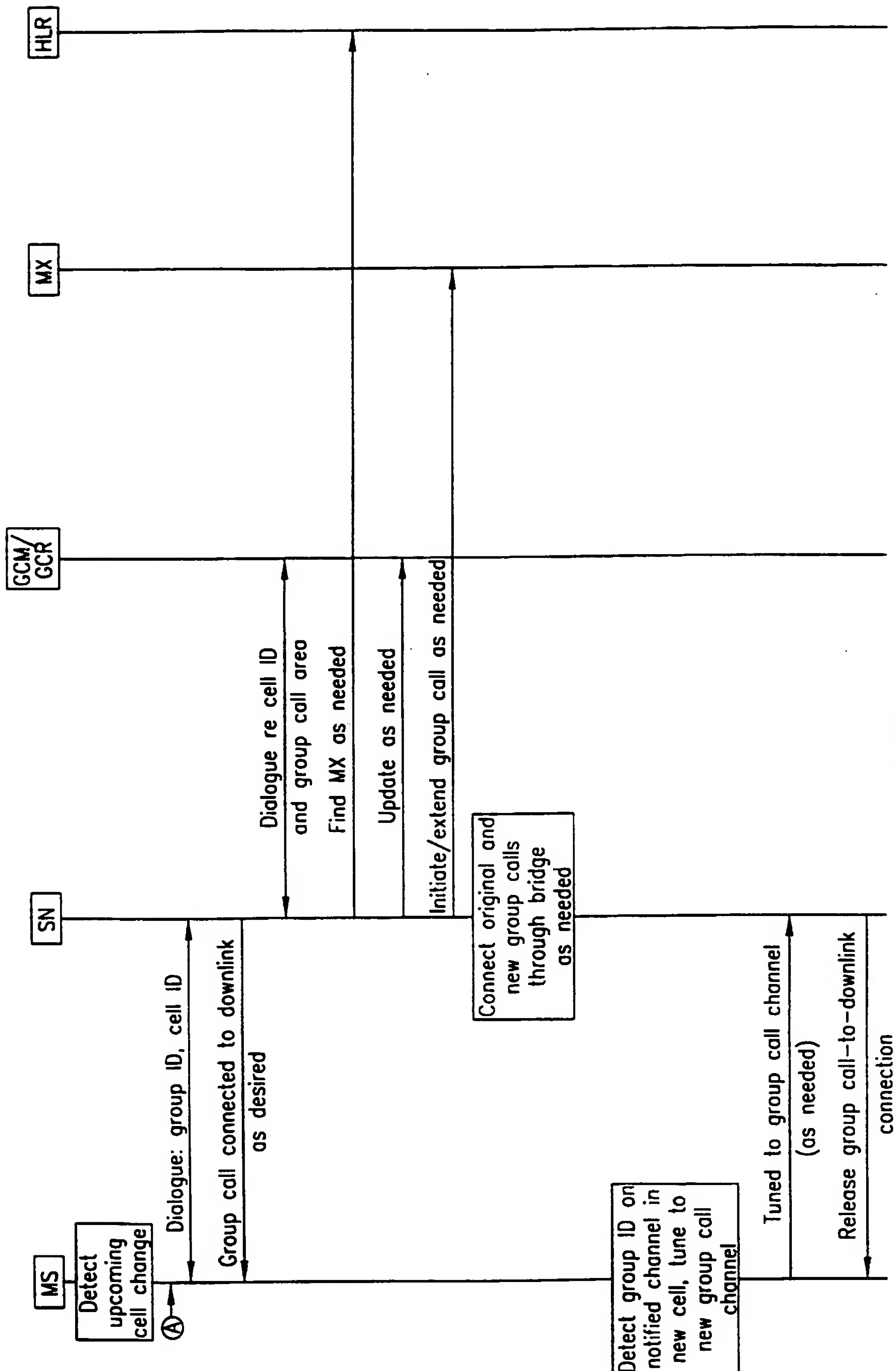


FIG. 8

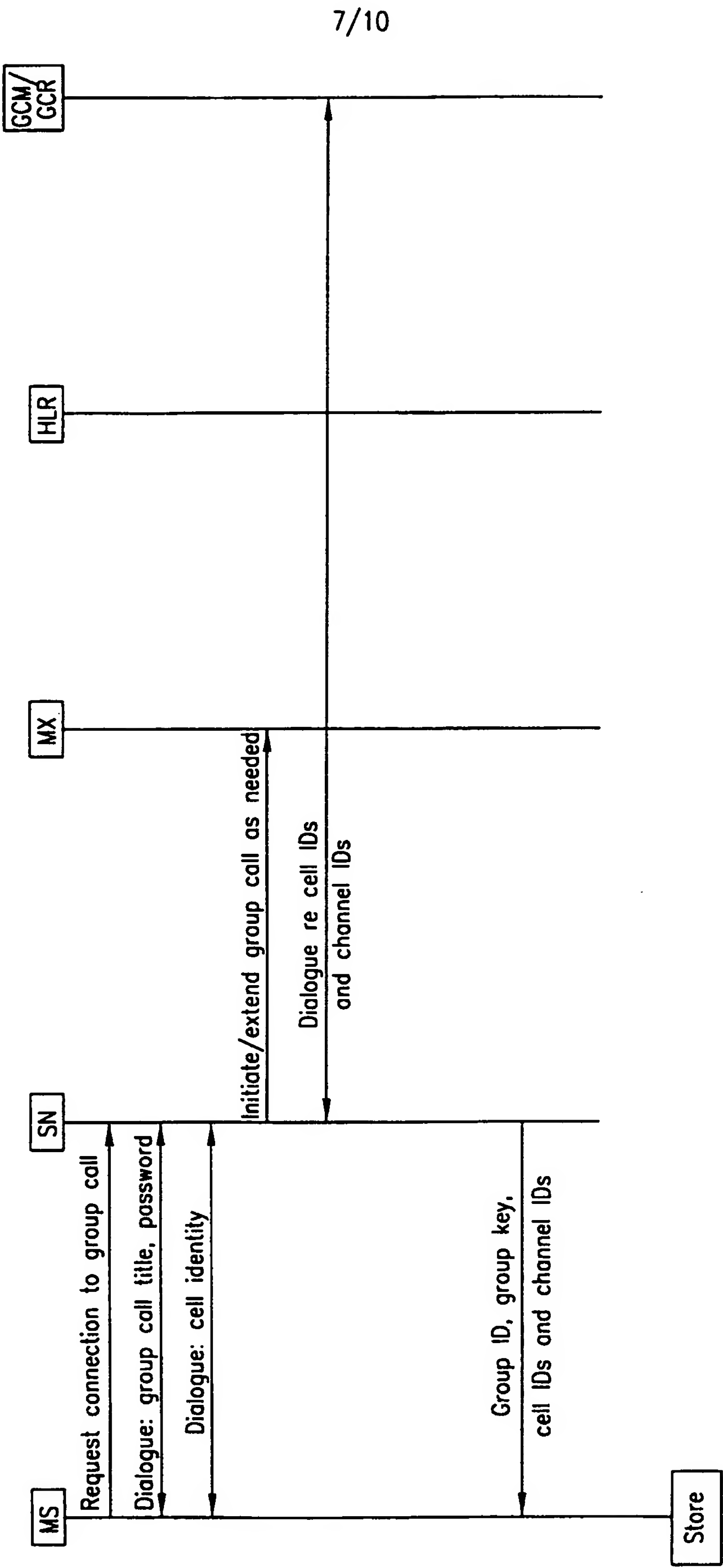


FIG. 9

8/10

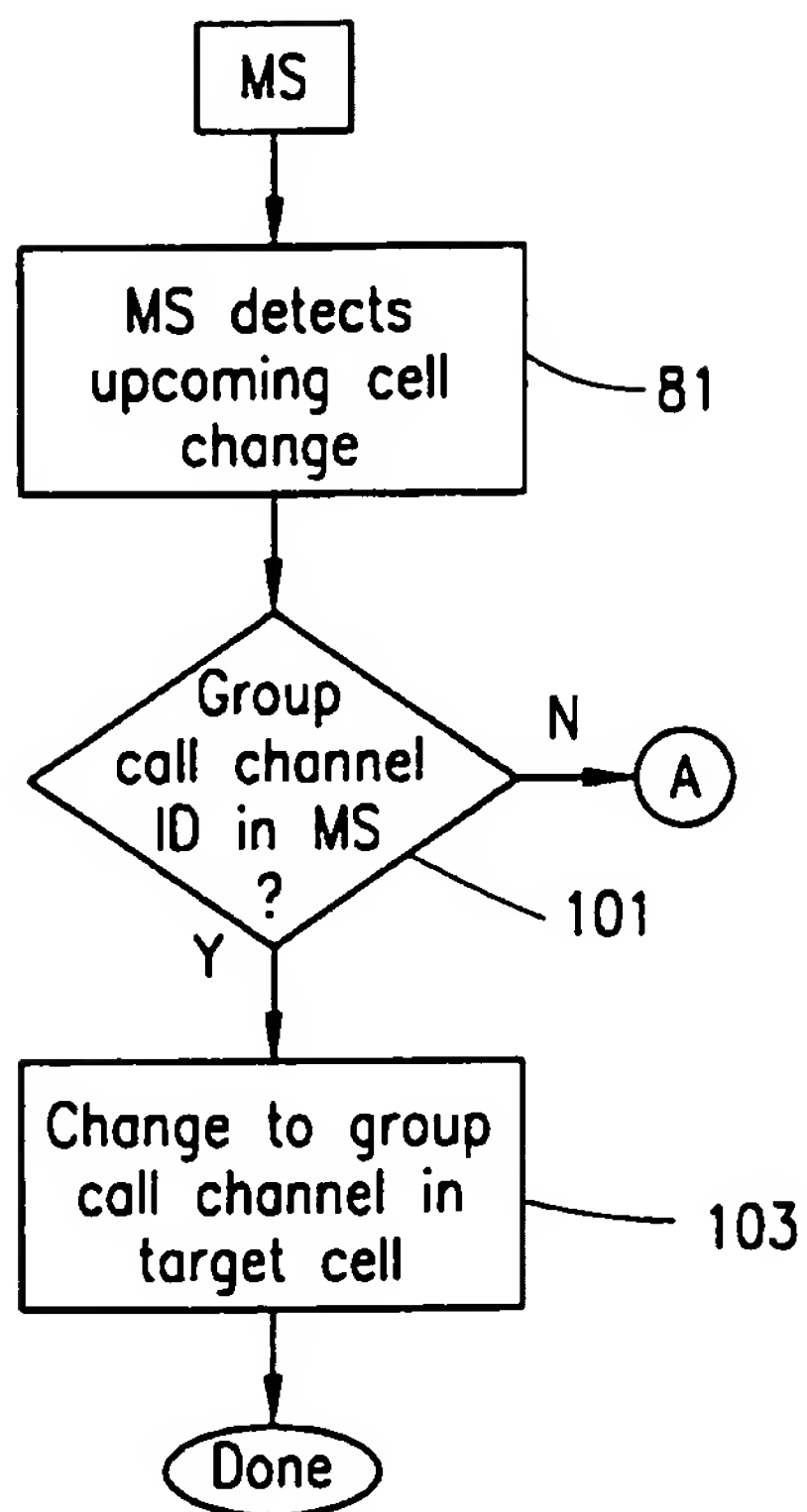


FIG. 10

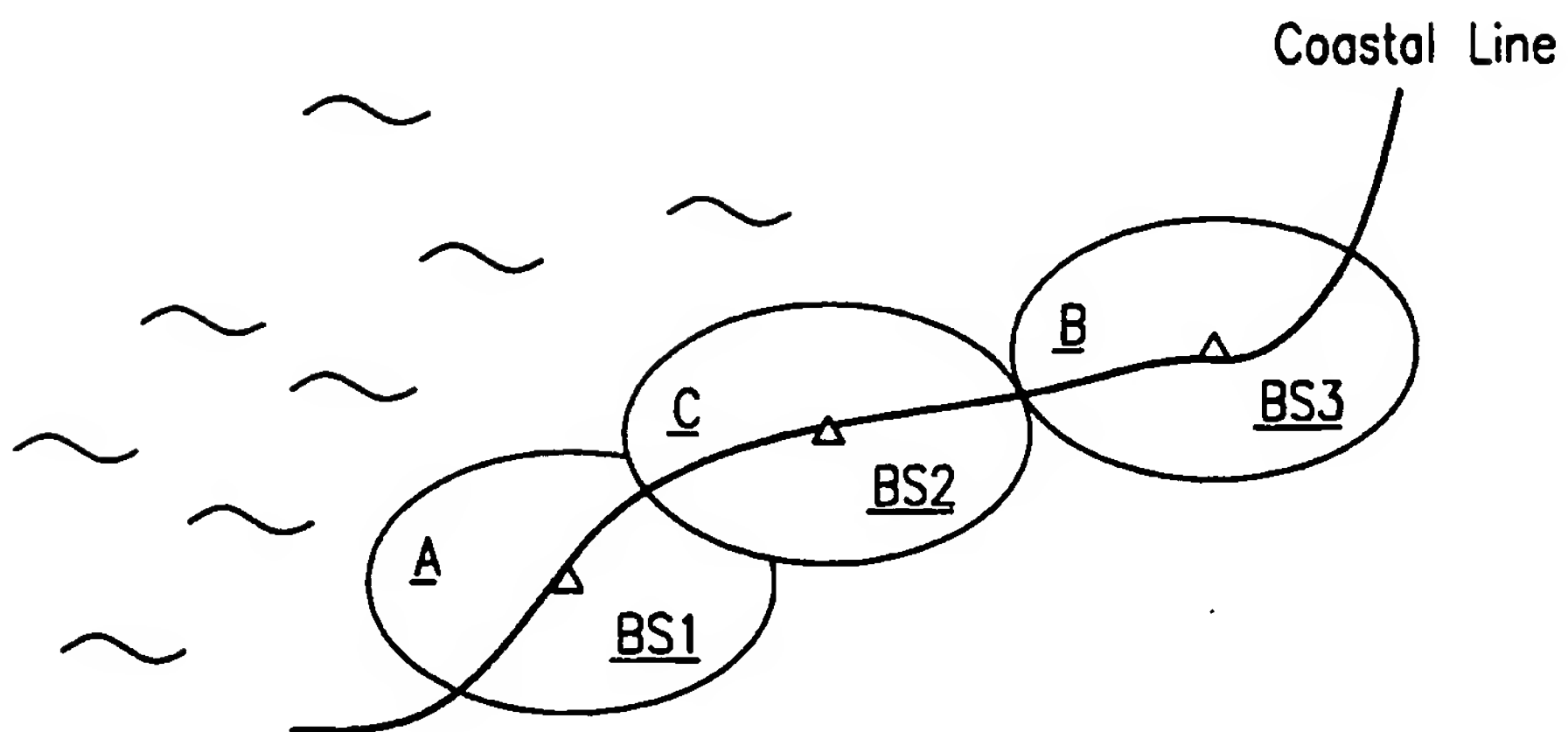


FIG. 15

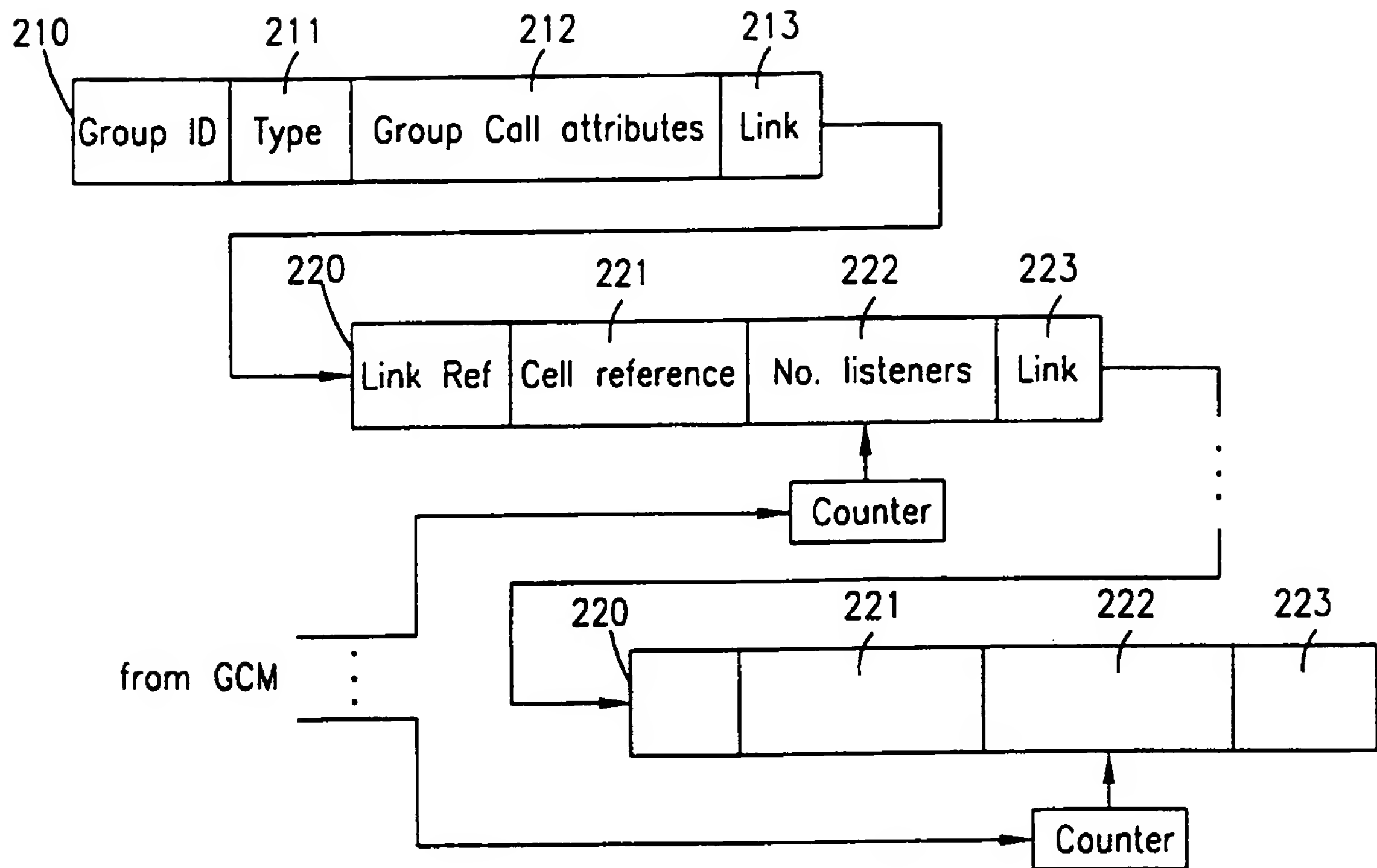
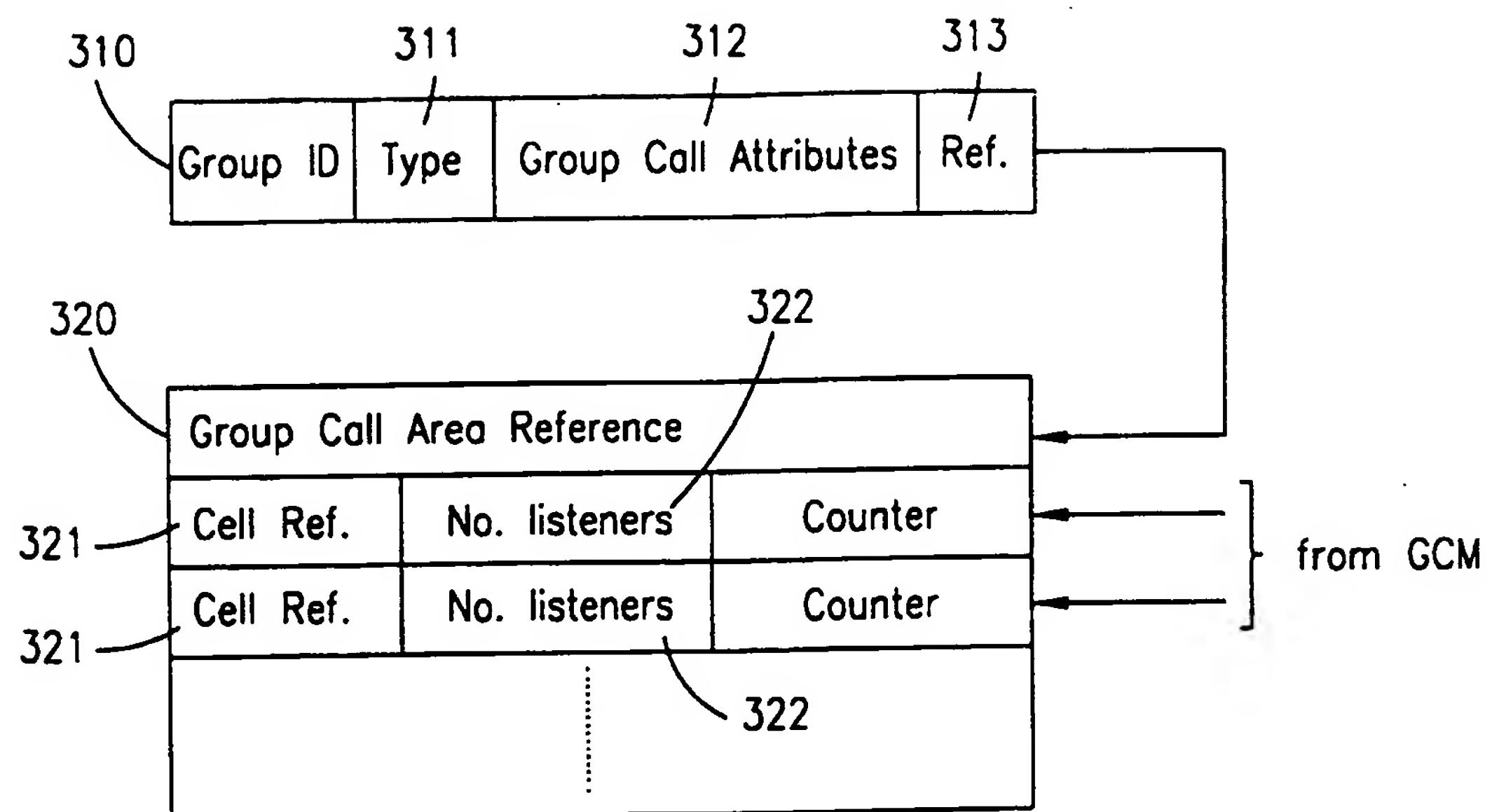


FIG. 12

*FIG. 13*

INTERNATIONAL SEARCH REPORT

International Application No

PCT/SE 00/02066

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 724 648 A (MCDONALD DANIEL ET AL) 3 March 1998 (1998-03-03) column 2, line 38 -column 4, line 11 column 5, line 1 - line 35 ---	1-52
A	EP 0 923 255 A (SIEMENS AG) 16 June 1999 (1999-06-16) column 4, line 52 -column 7, line 38 ---	1-52
A	WO 97 13383 A (BOSCH GMBH ROBERT ;ECKSTEIN TILLMANN (DE)) 10 April 1997 (1997-04-10) cited in the application page 7, line 15 -page 8, line 26 page 9, line 9 -page 10, line 33 -----	1-52

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

21 December 2000

Date of mailing of the international search report

29/12/2000

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Heinrich, D

INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern. Application No
PCT/SE 00/02066

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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